
Software Requirement Specification

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1. Introduction

Road accidents are a major concern globally, especially in developing countries like Pakistan, where delayed reporting and rescue response lead to increased casualties. Manual monitoring of traffic CCTV cameras is ineffective due to human limitations in identifying accidents instantly. To address this, our project proposes an AI-driven accident detection system capable of real-time monitoring, automated accident recognition, and immediate alert generation. ability.

2. Vision Document

2.1. Problem Statement:

Table 1: Problem Statement

Category	Description
Problem	<ul style="list-style-type: none">• Delayed detection• lack of real-time alerts• high fatalities due to late responses.
Affects	<ul style="list-style-type: none">• Road users• Emergency services• Traffic authorities
Impact	<ul style="list-style-type: none">• Increased loss of life• Traffic jams• Reduced trust.
Solution	AI-powered system that will: <ul style="list-style-type: none">• Detects collisions, immobility, and abnormal vehicle motion.• Stores accident logs with timestamp, location, and video snippets.• Generates real-time alerts (dashboard, SMS, Email, WhatsApp).• Demonstrates feasibility in controlled environments such as campuses, parking lots, toll plazas, and hospital entrances.

2.2. Business Opportunities

The system offers governments, smart city projects, and traffic management authorities a reliable and automated accident monitoring tool. By reducing emergency response times, it can save lives, optimize traffic management, and provide valuable data for policy-making and urban planning. Insurance companies and logistics firms can also benefit from automated evidence collection.

2.3. Objectives

Following are the objectives of AI based accident detection system:

- To detect road accidents in real-time using AI (CNN + LSTM).
- To send instant alerts to hospitals, police, and traffic control centers.
- To provide a centralized dashboard for monitoring and reviewing accidents.
- To store accident video snippets and images securely for future reference.
- To improve emergency response time and reduce fatalities.

2.4 Scope

The system will analyze live or uploaded video feeds from traffic surveillance cameras. Upon detecting an accident, it will generate alerts through multiple communication channels (SMS, Email, WhatsApp) and update a centralized dashboard. The system will also maintain a secure, searchable repository of accident logs, including metadata (time, location, severity).

2.5 Constraints

- 2.6 Dependent on internet connectivity for alert transmission.
- 2.7 Processing speed limited by available computational resources (GPU/Server).
- 2.8 Privacy concerns due to continuous video monitoring.
- 2.9 Initial model accuracy depends on quality and diversity of training datasets.
- 2.10 Requires high-quality video input for reliable AI detection.

2.11 Stakeholder and User Description

2.11.1 Market Demographics

- ☐ **Primary Users:** Traffic authorities, hospitals, police departments.
- ☐ **Secondary Users:** Insurance companies, city planners, logistics firm

2.11.2 User Environment

- Control rooms equipped with video surveillance dashboards.
- Mobile devices for receiving alerts (SMS/Email/WhatsApp).
- Cloud/server environment for AI processing and storage

2.11.3 Stakeholder Profiles

2.11.3.1 Supervisor Team

Table 2: Supervisor Team

Representatives	Supervisor: Co-Supervisor:
Description	They are involved in supervising activities for the development process.
Type	Technical stakeholders with expertise in AI, video processing, and system design.
Responsibility	<ol style="list-style-type: none">1. Provide direction to the development team.2. Ensure timely completion of the project.3. Validate that the system meets industry and research standards.4. Track project milestones and progress.5. Ensure proper documentation is followed.6. Review system testing and performance.7. Ensure final product delivery matches requirements.

Success Criteria	Completion of committed features and achieving accurate accident detection results.
Involvement	<ol style="list-style-type: none"> 1. Requirement reviewer 2. Senior managers 3. Review project progress
Comments/Issues	None

2.11.3.2 Development Team

Table 3: Development Team

Representatives	Developers, AI Engineers, System Designers
Description	Responsible for implementing and developing the AI-based accident detection system.
Type	Technical stakeholders
Responsibility	<ol style="list-style-type: none"> 1. Conduct research on CNN+LSTM models. 2. Develop accident detection algorithms. 3. Build dashboard and alert system. 4. Integrate video input and storage modules. 5. Perform testing and debugging. 6. Document design and progress.
Success Criteria	Successful development and deployment of accident detection, alerting, and storage features.
Involvement	<ol style="list-style-type: none"> 1. Research and development. 2. Documentation. 3. Testing and deployment.
Comments/Issues	None

2.11.3.3 *End Users*

Table 4: End Users

Representatives	Traffic Authorities, Police, Hospitals
Description	They are the actual users of the system who will rely on accident detection and alerts.
Type	External stakeholder
Responsibility	1. Use the system for monitoring traffic. 2. Receive and respond to accident alerts. 3. Access stored accident logs for verification.
Success Criteria	Quick and efficient use of the system to improve emergency response.
Comments/Issues	None

2.11.3.4 *Government Officials*

Table 5: Government officials

Representatives	Transport Department, Road Safety Authorities
Description	They use collected accident data for policymaking, urban planning, and safety enforcement
Type	Internal Stakeholders
Responsibility	1. Review accident data and statistics. 2. Implement policies to reduce accidents. 3. Approve integration with city-wide surveillance.
Success Criteria	Use of system data for evidence-based decision-making and accident reduction strategies.

Involvement	Policy review and enforcement.
Comments/Issues	None

2.11.3.5 *Admin*

Table 6: Admin

Representatives	System Administrator
Description	Manages the system, user access, and storage of accident logs.
Type	Internal Stakeholder
Responsibility	<ol style="list-style-type: none"> 1. Manage dashboard and alerts. 2. Configure user roles and permissions. 3. Ensure secure data storage. 4. Approve or restrict system access.
Involvement	None
Comments/Issues	None

2.11.4 Stakeholder Summary

Table 7: Stakeholder Summary

Name	Description	Responsibility
Development Team	The development team will be involved in designing, implementing, and testing the AI-based accident detection system.	<ol style="list-style-type: none">1. Fully involved in system development.2. Specify and refine requirements.3. Conduct research on CNN+LSTM accident detection models.4. Implement dashboard, alerts, and storage modules.5. Ensure successful deployment of the proposed system.
Supervisor Team	Guides the development team to ensure project success. Provides technical oversight and domain expertise.	<ol style="list-style-type: none">1. Provide direction and supervision.2. Review progress and documentation.3. Ensure system meets quality and research standards.4. Support the team in solving technical challenges.
End User	End users include traffic authorities, hospitals, and police who will operate the system to receive accident alerts.	<ol style="list-style-type: none">1. Use the system for accident monitoring.2. Respond to notifications.3. Access accident logs for emergency response and verification
Admins	Responsible for managing the system, users, and stored accident data.	<ol style="list-style-type: none">1. Configure user roles and permissions.2. Manage alerts and dashboard settings.

		<p>3. Ensure secure storage of accident logs.</p> <p>4. Maintain system operations.</p>
Government Officials	Includes transport and road safety authorities who will use accident data for policymaking and enforcement.	<p>1. Review and analyze accident statistics.</p> <p>2. Implement policies to improve road safety.</p> <p>3. Approve integration with city-wide surveillance systems.</p> <p>4. Utilize logs for legal or administrative actions.</p>

3. System Requirements Specification

3.1 System Features

- **Video Input:** Real-time CCTV streaming and video uploads.
- **Accident Detection:** AI-based CNN+LSTM model for anomaly detection.
- **Alert System:** Dashboard alerts + multi-channel notifications (SMS, Email, WhatsApp).
- **Data Storage:** Secure accident logs with timestamp, location, images and video snippets.
- **Dashboard:** Web-based monitoring interface for authorities.

3.2 Functional Requirements

The system must fulfil specific functional requirements, including:

3.2.1 Video Processing & Accident Detection

FR1: The system shall accept live CCTV video streams as input.

FR2: The system shall allow uploading of recorded traffic videos.

FR3: The system shall process video frames using CNN+LSTM models.

FR4: The system shall detect accidents with a defined confidence threshold.

3.2.2 Alert System

FR5: The system shall notify stakeholders via SMS, Email, and WhatsApp.

FR6: The system shall update the accident status on the dashboard in real-time.

FR7: The system shall attach accident evidence (images + short video snippet) in the alert.

3.2.3 Storage and Logs

FR8: The system shall store accident logs with metadata (time, location, type).

FR9: The system shall allow authorized users to query and retrieve past logs.

FR10: The system shall ensure secure access control for sensitive data. It shall automate the process to ensure swift forwarding to the department head and Anti-Corruption agency.

3.2.4 Dashboard and Administration

FR11: The system shall provide a centralized dashboard for monitoring.

FR12: The dashboard shall display live feeds, detected accidents, and alerts.

FR13: The administrator shall be able to configure alert recipients.

FR14: The system shall allow role-based access for different e Stakeholders.

3.3 Non-Functional Requirements

3.3.2 *Performance*

Must detect accidents within 3–5 seconds of occurrence.

3.3.3 *Privacy*

The system handles sensitive video feeds, accident logs, and user information in a way that protects individuals' identities and complies with data protection regulations

3.3.4 *Compatibility*

It must work seamlessly on various devices and platforms.

3.3.5 *Scalability*

Support for integration with hundreds of traffic cameras.

3.3.6 *Usability*

User-friendly dashboard accessible via web and mobile devices.

3.3.7 *Maintainability*

Modular architecture for easy updates to AI models.

3.3.8 *Reliability*

System uptime of at least 99%.